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Indian Standard

TECHNICAL CONDITIONS FOR THE SUPPLY OF HOT ROLLED BILLETS, BLOOMS, SLABS AND BARS FOR CLOSED DIE FORGINGS

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TECHNICAL CONDITIONS FOR THE SUPPLY OF HOT ROLLED BILLETS, BLOOMS, SLABS AND BARS FOR CLOSED DIE FORGINGS

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(*Continued on page* 9)

Indian Standard

TECHNICAL CONDITIONS FOR THE SUPPLY OF HOT ROLLED BILLETS, BLOOMS, SLABS AND BARS FOR CLOSED DIE FORGINGS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 10 December 1980, after the draft finalized by the Steel Forgings Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 After the publication of Indian Standards covering steel forgings and raw material for steel forgings, there has been a persistent demand from the industry and users for an Indian Standard covering dimensional tolerances of forging stock and the limits for surface defects in such material. Accordingly it has been decided to formulate this standard.

0.3 For the benefit of the purchaser an informative Appendix A giving particulars to be specified while ordering steel is included.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard applies to hot rolled billets, blooms, slabs and bars of plain carbon steel as well as alloy steel used in forging industry as raw material.

2. PERMISSIBLE DIMENSIONAL AND FORM VARIATIONS

2.1 Sizes — The tolerances on sizes, diameter in case of rounds and side widths in case of square shape shall be in accordance with the tolerances specified for Grade I and Grade II in IS : 3739-1972†.

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*Rules for rounding off numerical values (*revised*).

†Dimensional tolerances for carbon and alloy constructional steel products.

2.1.1 Tolerances for dimensions over 200 mm and above shall be as per IS : 1852-1979* unless otherwise agreed to between the manufacturer and the purchaser of the raw material.

2.1.2 Preferred sizes shall be as given in Table 1.

TABLE 1 RECOMMENDED SIZES FOR ROUNDS AND ROUND CORNERED SQUARES FOR FORGING QUALITY STEEL

Sl No.	Size mm	Sl No.	Size mm
1.	6	21.	48
2.	8	22.	50
3.	10	23.	52, 55
4.	12	24.	57
5.	16	25.	60
6.	18	26.	63
7.	20	27.	65
8.	22	28.	70
9.	23·5	29.	75, 78
10.	25	30.	80
11.	27	31.	85
12.	28	32.	90
13.	30	33.	95
14.	32	34.	100, 105
15.	34	35.	110, 120
16.	36	36.	125
17.	38	37.	140
18.	40	38.	160
19.	42	39.	180
20.	45	40.	200

2.2 Length

2.2.1 The length of the billets, blooms, slabs and bars shall be 3 to 6 metres. If required other lengths may be supplied as agreed to between the manufacturer and the purchaser of the raw material.

2.2.2 If required in multiple length of cut billets, blooms, slabs and bars for forging, total length ordered shall have a tolerance of ${}^{+0.5}_{-0.0}$ percent of the length of the bar ordered.

2.3 Weight

2.3.1 The variation in weight per metre of the billets, blooms, slabs and bars shall be within the permissible variation applicable to the

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*Rolling and cutting tolerances for hot rolled steel products (*third revision*).

cross-sectional area calculated as per tolerances given in IS : 3739-1972*. When the section is other than perfect square or round such as round cornered square, bulge square, gothic, etc, the interpretation of the cross-sectional shape shall be well defined by the manufacturer to compute the weight for unit length. The manufacturer will also supply the information regarding the weight per metre and the tolerance on weight per metre.

2.4 Straightness and Twist

2.4.1 The billets, blooms, slabs and bars shall be straight within 3 mm for every metre length.

2.4.2 Radial twist more than 3° measured over 1 metre of billets, blooms, slabs and bars shall not be permitted.

3. SURFACE DEFECTS

3.1 Billets, blooms, slabs and bars shall have high standard of surface quality. The surface conditioning will be such as to remove defects detrimental to end products.

3.2 Seams

3.2.1 The billets, blooms, slabs and bars shall be cut to two times the maximum cross-section (maintaining the ends perfectly square). After heating to forging temperature and soaking, the specimen will be upset between two flat surfaces so that the final length is reduced to 50 percent of the original length. The seams, if any, on the specimen should not open-out such that the final depth is not more than that specified in **3.2.3.**

3.2.2 For general forging purposes the permissible depth for seams shall be as given in Table 2.

TABLE 2 PERMISSIBLE DEPTHS OF SEAMS (BEFORE CONDITIONING) FOR GENERAL APPLICATION

DIA/SIDE LENGTH, mm	PERMISSIBLE DEPTH OF SEAMS*
Up to 25	3 percent or 0·5 mm whichever is less
25 to 150	2 percent or 2 mm whichever is less
Above 150	1·5 percent or 3 mm whichever is less

*For special application the depth of seam can be reduced further as agreed to between the manufacturer and the purchaser.

3.2.3 The material must be conditioned to remove injurious surface defects so that the final depth of seams after conditioning does not exceed 0·25 mm for sections up to 50 mm dia/side length and 0·5 mm for section up to 150 mm dia/side length. The width of the conditioning should be at least four times its greatest depths. Also the area of cross-section after conditioning should be within the permissible limits specified for the area.

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*Dimensional tolerances for carbon and alloy constructional steel products.

3.2.4 For unforged portion (shank) of the upset forgings which remains unmachined, depth of seam which are not normally permitted due to criticality of the application may be subject to agreement between manufacturer and purchaser.

3.3 Shallows

3.3.1 All shallows shall be conditioned. The criteria for conditioning the shallows will be the same as those applicable to seams.

4. BANDED STRUCTURE

4.1 Freedom from banded structure shall be subject to agreement between the manufacturer and the purchaser and shall be based on photomicrograph. Banding shall be tested in the straight annealed ferritic/pearlitic condition.

5. METHOD OF MANUFACTURE

5.1 Billets, blooms, slabs and bars for forgings shall be manufactured from killed steel made by open hearth, electric, basic oxygen, a combination of these processes or any other suitable method which will meet the requirements of the standard.

5.2 Steel shall be killed.

5.3 Sufficient discard shall be made from each ingot to secure freedom from piping, porosity and undue segregation.

5.4 Material shall be made from ingot at least 4 times the area of the product for general purpose and 6 times for steels used for upset forging.

5.5 Inclusion rating shall be specified by the purchaser and shall be as given in IS : 4163-1967*.

5.6 Grain size shall be between 5 and 8 when measured in accordance with IS : 2853-1964†. For special applications where killing by aluminium can not be permitted the grain size shall be between 3 and 8.

---

*Determination of inclusion content in steel by microscopic method.

†Method for determining austenitic grain size of steel.

APPENDIX A

(*Clause* 0.3)

INFORMATION TO BE FURNISHED BY THE PURCHASER

A-1. BASIS FOR ORDER

A-1.1 While ordering for steel specified by this standard, the purchaser should specify clearly the following:

a) Grade designation;

b) Description regarding size, length, finish, etc;

c) Condition of supply;

d) Test required;

e) Method of manufacture;

f) Any special requirements; and

g) Test report, if required. (*see* Appendix B)

APPENDIX B

[*Clause* A-1.1 (g)]

MANUFACTURER'S NAME AND ADDRESS

Test Certificate No. .... Date.......................

Customer...

Steel Specification: .... Section........... Tonnage.................

CHEMICAL ANALYSIS

HEAT No.	C	Mn	Si	P	S	Cr	Ni	Mo	OTHERS

PHYSICAL PROPERTIES

Supply condition ☐ As rolled ☐ Normalised ☐ Annealed ☐ Control cooled

HEAT NUMBER	HARDNESS HB	TENSILE STRENGTH kgf/mm^2	ELONGATION PERCENT $5{\cdot}65\sqrt{S_o}$	IMPACT STRENGTH kgm	GRAIN SIZE

JOMINY HARDENABILITY

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Surface condition
Grain size 5-8
Internal defects
Inclusion rating

NOTE — Complete information will be furnished by manufacturer except for Jominy hardenability, tensile strength, elongation, impact strength, which will be furnished only on special request by the customer.

Certified that the material is passed as forging quality steel and is free from internal pipes, cavities and deep seams as per IS : 4163-1967* and IS : 9684-1980†.

Signature
Designation
For XYZ Iron & Steel Company

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*Determination of inclusion content in steel by microscopic method.

†Technical conditions for the supply of hot rolled billets, blooms, slabs and bars for close die forgings.

(*Continued from page* 2)

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INDIAN STANDARDS

ON

STEEL FORGINGS

IS:

1875-1978	Carbon steel billets, blooms and slabs for forgings (*fourth revision*)
2004-1978	Carbon steel forgings for general engineering purposes
2611-1964	Carbon chromium molybdenum steel forgings for high temperature service
3261-1980	Carbon steel forgings for shipbuilding industry (*first revision*)
3445-1966	Forged steel rolls
3469 (Parts I to III)-1974	Tolerances for closed die steel forgings
3479-1969	General requirements for steel drop, upset and press forgings
4367-1967	Alloy and tool steel forgings for general industrial use